

Modified Sulfur Coating of Urea with Polymers Addition in Spouted Bed

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1. Summary

In this research, the influence of polymer-addition on the efficiency of sulfur coated urea (SCU) slow release process has been investigated.

Urea as a fertilizer has high solubility rate in water. Then it coats with another materials such as sulfur in order to decrease release rate. Generally, sulfur is a porous material exhibiting low mechanical strength. Therefore in order to decrease porosity filler materials have been added and simultaneously plasticizers have been added to increase its flexibility. Yellow wax (with $m_p = 62-65^\circ\text{C}$) and paraffin (with $m_p = 45-50^\circ\text{C}$) used as filler, DCPD (dicyclopentadiene) used as plasticizer. The granules of urea were coated with various mixtures of sulfur, filler and plasticizer. Two methods have been used: one of them is urea is coated with mixture of sulfur, plasticizer and filler that they have been mixed perfectly. The other is urea is coated with the mixture of sulfur and plasticizer and then it's coated with filler as a sealant (2-layer method). Spouted bed has been used as a coating system, and pressure and flow rate of spouting air are the spouted bed's operation variables. In order to obtain information about the surface morphology of the coat, SEM technique has been used. 7-day release tests show the effect of polymer-addition on release rate.

Keyword: SCU, 7-day release test, plasticizer, filler, spouted bed.

2. Extended Abstract

1. As it is observed that the sulfur- paraffin and sulfur-wax mixtures have less porosity than sulfur (Fig.1). Release rate decreased when wax or paraffin is added (Fig. 2).

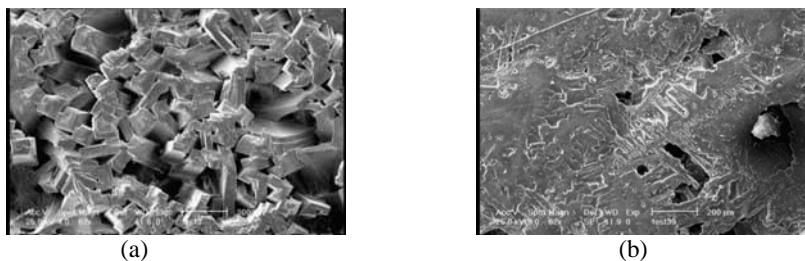


Fig.1: Effect of paraffin addition on coating surface. a: Sulfur. b: Sulfur- paraffin

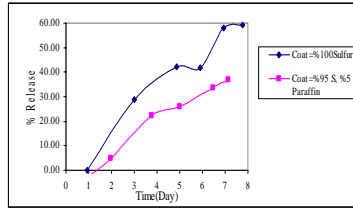


Figure 2: comparison 7- day release test between sulfur and sulfur-paraffin mixture

Increasing the amount of paraffin (or wax) to sulfur resulted in a decrease the surface cracks (Fig. 3).

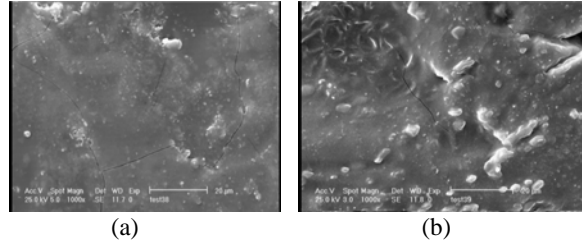


Fig. 3: Effect of the increasing wt% paraffin on surface cracks.

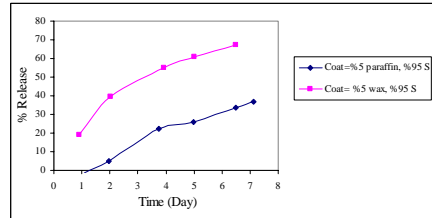


Fig. 4: Comparison between wax and paraffin on slow release rate

Plasticizers increase sulfur flexibility. DCPD as a plasticizer decrease release rate of urea. The mixture of sulfur/DCPD and paraffin as a sealant proved to have the optimum slow release rate (Fig.5)

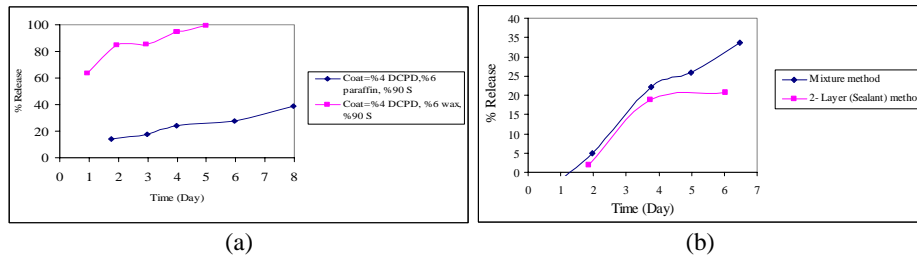


Figure 5: (a) Comparison between the mixtures of sulfur/paraffin/DCPD & sulfur/ wax/ DCPD, (b) comparison between two methods.

References:

Bexton, Stewart G., et al., 'Manufacture of urea sulfur fertilizer', U.S. Pat. No. 4330319, May 18, 1982.
 Michael M. S. Choi, Axel Meisen, (1997), 'Sulfur coating of urea in shallow spouted beds', Chem. Eng. Science, vol. 52, 1073-1086.
 Timmons; Richard J., 'Sulfur-based encapsulants for fertilizers', U. S. Pat. No. 4636242, January 13, 1987.
 Gullett; Larry L.; Simmons; Charles L., 'Sulfur-coated urea', U. S. Pat. No. 4676821, June 30, 1987.